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#### How to cite:

Scott, Peter; Tomadaki, Eleftheria and Quick, Kevin (2007). The shape of online meetings. The International Journal of Technology, Knowledge, and Society, 3(4) pp. 1–16.

For guidance on citations see [FAQs](#).

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Version: Version of Record

Link(s) to article on publisher's website:

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The International  
**JOURNAL**  
*of* TECHNOLOGY,  
KNOWLEDGE  
& SOCIETY

Volume 3

The Shape of Live On-line Meetings

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THE INTERNATIONAL JOURNAL OF TECHNOLOGY, KNOWLEDGE AND SOCIETY  
<http://www.Technology-Journal.com>

First published in 2007 in Melbourne, Australia by Common Ground Publishing Pty Ltd  
[www.CommonGroundPublishing.com](http://www.CommonGroundPublishing.com).

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ISSN: 1832-3669  
Publisher Site: <http://www.Technology-Journal.com>

THE INTERNATIONAL JOURNAL OF TECHNOLOGY, KNOWLEDGE AND SOCIETY is a peer refereed journal. Full papers submitted for publication are refereed by Associate Editors through anonymous referee processes.

Typeset in Common Ground Markup Language using CGCreator multichannel typesetting system  
<http://www.CommonGroundSoftware.com>.

# The Shape of Live On-line Meetings

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*Abstract: Live videoconferencing has become an integral part of international virtual learning and working with professionals, educators and students using online meetings to enhance their collaboration from different parts of the world. This paper explores the visualization of a set of different online meetings produced by the FlashMeeting™ videoconferencing system. Our polar area visualization analysis reveals interesting patterns in participant dominance in online meetings: seminars, interviews, moderated project meetings, peer-to-peer meetings, web-casts and video lectures. Visualizing patterns in the use of foreground and background communication channels is a promising way to help us to start to explore individual user roles in different communities and in different meeting types.*

**Keywords:** Live videoconferencing, Visualizing video meetings, FlashMeeting, User meeting roles

## Introduction

**V**IRTUAL MEETINGS ARE now commonplace. Indeed, the first usable video-phone was released by AT&T back in the 60's (Egido, 1988), making it possible to conduct more naturalistic business with remote colleagues, reducing travel costs and environmental impact. Computer-supported collaborative environments have been successfully applied to distance learning in a variety of different contexts (see e.g. Maybury, 2001). For technology enhanced learning, audio and videoconferencing offer the opportunity to teachers and learners from remote locations to interact with each other (Rosell-Aguilar, 2005) and connect for effective assistance, supervision or examination, enhancing their collaboration, as well as the learning experience. It also provides for a very new set of learning scenarios, in which for example, self-motivated learners can now collaborate with each other, exchange views on common activities, critique each other's work; share learning material and study together in a worldwide context.

This technology clearly impacts upon group interaction (Mark, 1998) and is increasingly used to build and transform communities of practice (Hoadley and Kilner, 2005, Quan-Haase, 2005, Hu et al, 2002). In this paper, we explore the visualisations of a sample of different types of online meetings, presenting different shapes. These meetings are naturalistic events, held via the FlashMeeting™ videoconferencing tool (FlashMeeting, 2007), as used by different communities of practice. These communities include independent learners, teachers collaborating on technology-enhanced learning projects and teachers

fostering remote learners. Videoconferencing is used for peer-to-peer meetings amongst learners, sharing the same learning interests, expectations and challenges. It can also be used for interviews, project meetings with multiple participants, chaired by a leader or for webcasts of physical lectures, virtual seminars and video lectures connecting remote participants and institutions. We are interested in the communication patterns that naturally emerge from real meetings of different types and motivations, and with different communicative goals.

It may be for example, that audio, video and text channels of communication are used in different ways in these different contexts. Video can be used for actual work, whilst text can be used for emotional support and social interaction. The intensity of the use of different communication channels results in the formulation of different roles that participants may play in a virtual meeting. It may be that some act as the meeting 'leaders' (Sudweek and Simoff, 2005), making more extensive use of some or all communication channels available. Previous studies suggest that "the tendency for the individual with the highest level of verbal participation to be chosen as the leader was of significant and strong magnitude", where salience, motivation and artefacts also contribute to the participation-leadership (Mullen et al, 1989). In Group Support Systems environments, the role of facilitator is important, "having the formal responsibilities of a technician" (Hedestig and Kaptelinin, 2003). Except assisting in the processes of a virtual meeting, a facilitator can also be involved in facilitating the content and tasks of a meeting (Miranda and Bostrom, 1997), often providing socio-emotional support (Kelly and



Bostrom, 1997). Other event participants remain silent, mentioned in the literature as 'lurkers' (Rafaeli et al, 2004, Takahashi et al, 2003, Nonnecke and Preece, 2000), who in the case of videoconferencing, attend the meeting without contributing significantly to audiovisual or text chat interactions. Interestingly, in peer-to-peer meeting types, the amount of broadcasts and chat messages can be equally divided amongst certain participants, whilst in presentation-like events, amongst several lurkers, a certain speaker dominates the audio and/ or chat channels. These roles can simulate the roles that would have been adopted in face-to-face communication, as "accuracy, over-confidence and size of intervals" have presented no significant differences in videoconferencing and face-to-face communication (Snizek and Crede, 2002).

## The System

(<http://www.prolearn-project.org/>)

(<http://openlearn.open.ac.uk/>)

(<http://labspace.open.ac.uk/>)

FlashMeeting is a 'light weight' videoconferencing tool, developed in the Knowledge Media Institute of the Open University in the UK. Over three years of research, more than 4,000 events have been recorded on the FlashMeeting servers. Interestingly, the tool has been used by a range of communities of teachers and learners in different locations worldwide and in a variety of ways, including peer-to-peer meetings or presentation-like types of events. Flashmeeting is enthusiastically used on a daily basis, as part of various e-Learning projects, especially by partners in several European educational institutions as part of the 'Prolearn Network of Excellence' project funded by the Information Society Technology programme of the European Commission, and which focuses on innovative aspects of technology enhanced professional learning. The system also forms part of the recently launched OpenLearn project, which aims at making freely available high quality educational resources of undergraduate and postgraduate levels. The system has been integrated with the Moodle system, in an experimental zone allowing self-motivated learners to download the OpenLearn free educational resources, as well as uploading educational content and connecting by instant messaging and videoconferencing with other learners who are enrolled on the same courses, with the goal

to stimulate the creation of communities of common interests.

As part of this latter 'OpenLearn' programme of work some of the extensive communities using this environment have been encouraged to publish the recordings of their events in a public forum. This public data provides us with a unique opportunity to explore a corpus of 'naturalistic' events in this paper and have the data itself (and its analysis) entirely public to you, the critical reader. Ethically and practically each event belongs to its members, and these have opted to publish them via the web pages cited. In this paper we have 'slightly' anonymized all these events by referring to participants by the first 3 characters of the names they used in the live event. This allows the community to withdraw their recording from the live website (should they choose to in future) leaving the analysis cited here anonymous. Should they leave their data in the public domain, then it is all published via the cited urls here. Although this is relatively rare in research, it is a feature of a naturalistic ethnography that we would strongly encourage.

FlashMeeting™ itself is a small applet, implemented in Adobe Flash™, which is a common, cross-platform, browser plug-in. In this way, FlashMeeting™ can be used by most people without any additional software installation. Only the booker of a meeting requires an account with the server and can then forward the meeting URL, generated by the booking, to the other participants, who simply join the meeting by clicking on the link. Unlike most existing desktop videoconferencing tools, FlashMeeting allows only one person to broadcast video and audio at any one time. In this way, everyone can be heard in a meeting without being interrupted. The participants have the options of 'raising a hand' to queue and wait for their turn to broadcast, or they can opt to instantly 'interrupt' the current speaker. Most users queue politely and click on 'interrupt' only in the case where the broadcaster cannot be heard.

The mock up screen of Figure 1 shows 'Julie', broadcasting, while 'Peter' and 'Simon' are next, having raised a symbolic hand. In addition to communication via the audio and video, there are also other communication channels including public group text chat, a voting system and emoticon mood indicators. URLs can also be shared for collaborative web browsing.



Figure 1: FlashMeeting Features

The audio-visual aspect of this interface clearly presents the most dominant or ‘foreground’ channel of communication in this tool, as it is always visible to all participants. However, it is not uniformly available, in the sense that only one participant may use it at any one time. Text chat is a somewhat less dominant feature of the interface as it is on a ‘tabbed window’ which can remain hidden if not chosen by the user. However, in principle, all users can use text chat at the same time, with no queuing and it is therefore potentially a more uniform ‘background’ channel to complement (and work in parallel with) the foreground audio-visual channel. Other communicative features, such as voting and using emoticons

represent more ‘side channels’ of communication or ‘paralinguistic cue’ channels.

Like some other software videoconferencing systems FlashMeeting allows events to be automatically recorded. Figure 2 shows a screenshot of the ‘FlashMeeting Memo™’ applet replaying one of the public meetings discussed below. The video window in the top left shows the current ‘broadcasting user’ (normally some part of their face or torso as in figure 1), however, in this particular case user THI is holding up his camera to point at his computer screen to show something for meeting attendees to comment upon.



Figure 2: The FlashMeeting Memo™ Applet Showing a Peer-to-Peer Event

This replay applet allows users to click on any part of the visualisation and replay from any point, pause or jump from the controllers below the video window. (As has already been noted, this screenshot has been anonymized to allow for the participants 'future right' to withdraw the live version from the public sample cited in the reference urls). The lower part of the figure 2 screenshot shows a linear visualization of the event, in which the horizontal bars represent one turn of the named user. Users are listed to the lower left in order of the amount of event time they speak. Ergo in this meeting user SCO spoke the longest, user STE next longest, etc. The horizontal lines also indicate where users joined and left the event, so most event participants were present for the full two hours, but user BAR joined for only half an hour in the middle of the event.

The linear visualization is very useful for the recording as it allows a replay user to jump easily amongst different user audiovisual turns, and it gives a clear view of contributions over time. The vertical line over the bars indicates the current point of the playback. It shows that the recording is playing back the start of a relatively long broadcast by user THI, as he presents some of his work to the others. However, from this visualization it is quite hard to see relative user impact over the whole event and to gauge the general shape of the event from this perspective. In this paper we propose that this linear time perspective can be combined with some other simple views to help us to better understand the nature of these events.

### The Polar Area Diagram Visualization

In the Crimean War, Florence Nightingale produced a 'polar area' diagram variant of a pie chart to provide a powerful illustration of the causes of death amongst the British forces (Nightingale, 1858). She divided the pie chart into 12 equal segments representing the months in one year of the fighting. In the chart the area of different pie-segments in each of the 12 regions was used to show that the real enemies were cholera, typhus and other diseases. In these visualizations, Nightingale's insight was that the area of the segments was the strongest visual cue to the relationship between these complex factors. In our work we have tried to build upon this insight with our own variant of the polar area diagram. We have taken the linear representations of the meeting (as represented by the bottom of figure 2) and combined them into polar area 'dominance' diagrams, which are automatically generated for each event. Samples of these charts are presented in figures 3 to 14 below.

The FlashMeeting™ broadcast dominance chart is a form of polar area diagram in which the circumference of the chart is divided according to each user's percentage of the total event audio-visual talk time. It excludes any 'silences' in the event, only counting the time in which users choose to take a turn to speak. So, in an hour-long event, if the combined broadcasts of all users totalled 50 minutes of that hour, then a participant who broadcast for 25 minutes would have half the chart circumference i.e. a segment of 180 degrees. In addition, the radius of each user's segment indicates the relative proportion of the number of broadcasts that the user made

compared to the others. So in the case in which the user who took the most turns in that meeting, 'broadcast' 40 times, their segment would be drawn to the full radius of the chart, whilst the segment of a user who spoke 20 times would be drawn to only half the full radius.

This means that we can define the broadcast dominance of a participant by the area of each chart segment, being a product of the proportion of the audio-visual time of the meeting by the number of audio-visual 'turns' taken.

The 'chat dominance' chart is a similar polar area diagram whose circle is divided according to each user's percentage of the total chat message character count. So, for example, if 6000 text-chat characters were typed by all event participants, a user typing 3000 of these characters would be represented by a segment with an angle of 180 degrees, or half of the total chart circumference. In addition, the radius of each user's pie segment indicates the relative proportion of the number of chat messages that the user made compared to the number of messages of the most active participant. So, for example, if the most dominant 'texting' user issued a total of 40 text messages, they would have a segment drawn to the full radius of the illustration, whilst a user with 20 messages would have a segment drawn to only half the full radius.

This means that we can define the chat dominance of a participant by the area of each chart segment, being a product of the proportion of the 'text typed' by the number of chat 'turns' taken.

It should be noted that our polar area visualizations are quite different to those of Florence Nightingale as the ordering of segments for us is a product of the analysis rather than an independent variable. Our dominance segments are ordered by area counter-clockwise from the top. The first segment has the largest area and the last segment has the least visible area. The numbers referred to in all subsequent figures represent the 'join' order of the participant (ie. the order in which they connect to the event). Because of this ordering of the segments, our charts have a tendency to an 'ammonite' shape, which would not have been found in the original Nightingale concept. It is the variance in these shapes, and what they can tell us about each set of events, that is the subject of this paper.

## Different Types of Online Meetings Using Various Communication Channels

FlashMeeting involves a range of communication channels, which are used to accomplish different communicative goals. Interestingly, the video and audio channels are mostly used to exchange inform-

ation related to the working context, whilst the text chat function is mainly used for emotional support and socialising in meetings with multiple participants. It is also important to distinguish between the different channels used in different meeting types. To investigate the use of different communication channels in different types of online meetings, we explore a sample event of each type from a set of online 'public' meetings (see Public FlashMeetings, 2007), which are offered by their participants to anyone in the world who wishes to view and learn from them.

## A Project Meeting

<http://flashmeeting.com/fm/4d0263-5623>

Within the corpus of thousands of events on this server to date, the formal business or project meeting is very common. Meeting 5623, illustrated in figures 3 and 4, is a typical shape for this large body of events. Figure 3 is indeed close to the sort of 'ammonite' that is a reflection of a relatively smooth dominance decrease in participation. The event is listed as a "project management board for the annual deliverable" and is clearly about project collaborative work. The event had 12 live participants and lasted approximately 62 minutes. Technically, 15 users are listed as connecting, but 3 of these are 'reconnects' of the same individual probably having experienced technical problems. This is why for example the user 'PRO' is listed as joining as both user 4 and 8 (probably having experienced technical problems).

In meetings with a fairly high number of participants, and with a relatively formal agenda structure, the role of the moderator is clearly important for task distribution and issue management. And, it is clear that most participants expect that person to 'dominate' the foreground channel. What is less usual in this example is that the meeting 'leader' dominates the background chat channel also. The most dominant broadcast user, 10/ELI, appears from the shape of the event to have taken such a role. She was responsible for 34 broadcast turns of the 121 turns taken, amounting to 22 minutes of audiovisual talk (36% of total broadcast time). When not dominating the audiovisual side of the event, user 10/ELI was also the most active in the chat, typing nearly half of the 5642 characters!

The second most dominant user was user 12/MIH in broadcasting and user 1/GAB in text chat. The most dominant user notwithstanding, all other users seem to play a role in this event, with those who are more dominant in the foreground, being much less dominant in the background and vice-versa. The side channels in this event are not used significantly, with few emoticons and no urls or voting, etc.



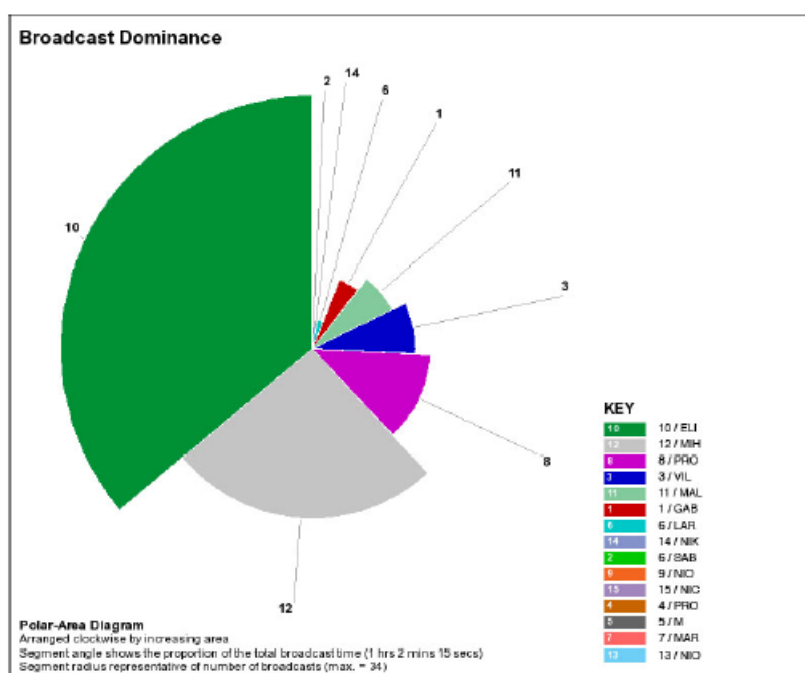


Figure 3: Broadcast Dominance in a Project Meeting

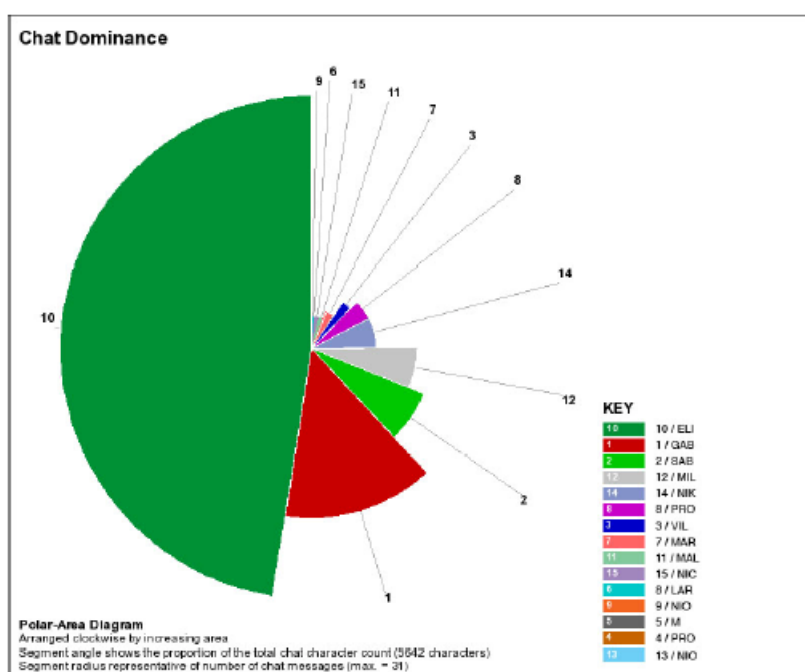


Figure 4: Chat Dominance in a Public Project Meeting

### An Academic Seminar

<http://flashmeeting.com/fm/4b8a1f-1606>

The academic seminar is another common shape in our FlashMeeting data sample, which is often an echo of the ammonite of the project or business meeting. Event 1606 is one of a public series of seminars on 'Learning Objects and Metadata' can be viewed at the web page hosting the public replays.

The first few of these seminars are organised by one individual, who acts as the leader/moderator, discussing different themes. The event examined here, includes 4 participants and could be described as an interactive presentation or seminar event. This event uses all of the communication channels available in FlashMeeting.

Event 1606 includes 144 turns at broadcasting lasting around 1 hour and 20 minutes. The meeting visualisation in figure 5 shows the dominant moder-

ator (user 4/ERI) interacting with different individuals in different phases of the meeting, with 61 broadcasts taking up nearly half of the event. His average broadcast is 34 seconds, nearly the same as the average broadcast duration of all speakers, showing effective interaction and equal time spent in turn taking amongst all participants. The relatively even balance of remaining users shown in figure 5 reflects that each student/researcher is speaking to the core academic by turns. Because of the relatively

small number of participants in this event, none is far from the foreground channel with respect to their contribution, so the background channel is not used much with only 15 text messages exchanged during the course of the event. As figure 6 shows nearly equal amounts of text messages were shared among the three less-dominant foreground participants, while the main speaker 4/ERI used the chat less than the others with 2 messages.

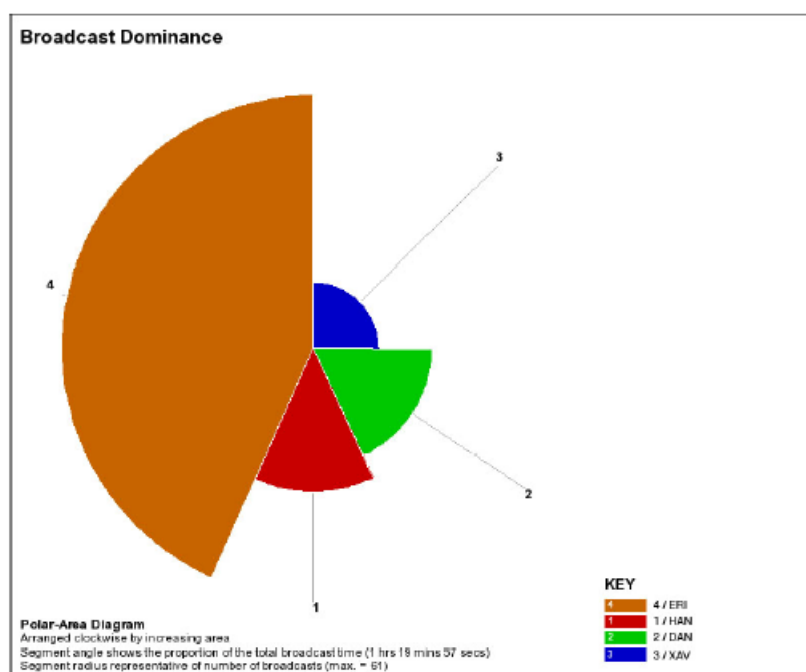


Figure 5: Broadcast Dominance in an Academic Seminar

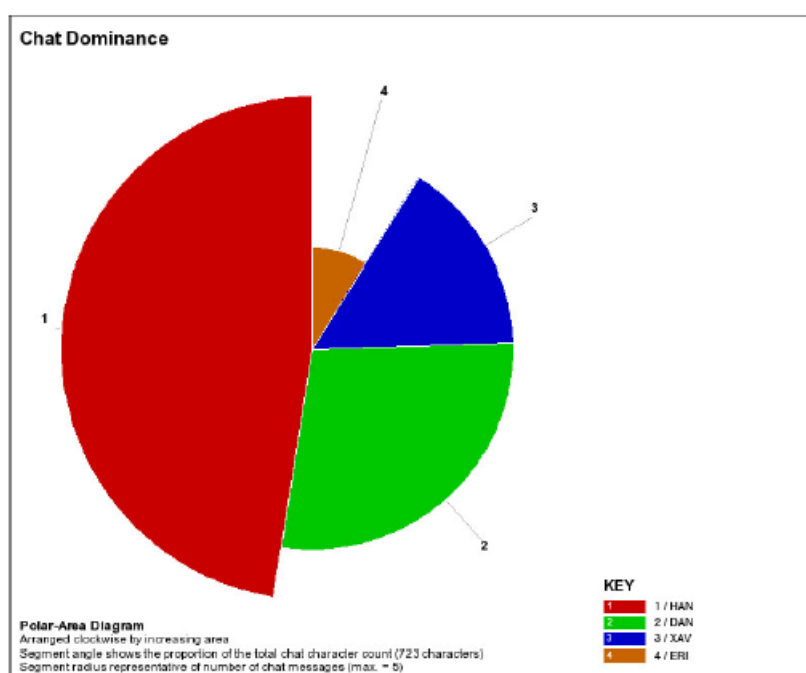


Figure 6: Chat Dominance in an Academic Seminar

## A Peer-to-Peer Learning Event

<http://flashmeeting.com/fm/d6cf16-5967>

When the managing academic is removed from an event it can become more peer-to-peer oriented. A community of animation students has held a series of meetings using FlashMeeting, some of which were made public. In these events, the students discuss common activities and collaborate on projects by expressing their views and answering each other's questions. Most of these meetings do not have a moderator, although certain students may be more dominant than others in certain communication channels. Event 5967 is the 8th in a long series of public meetings amongst students discussing com-

mon animation assignments, pictured in the screenshot of figure 2. This event was just under 2 hours long and included 5 participants, sharing amongst them a total of 100 broadcasts. From figures 7 and 8 it appears to be a peer-to-peer event, because of the relatively even spread of activity amongst the participants. In figure 7 the foreground audiovisual channel is shared amongst users 2, 1 and 4. Whilst in figure 8 we can see that all users are remarkably evenly dominant in the background chat with around 15% of the event each apart from 4/THI who has about 30% of the 5518 characters typed in the event. As 4/THI is the less active of the three main foreground channel users, this makes the meeting appear to be even more balanced.

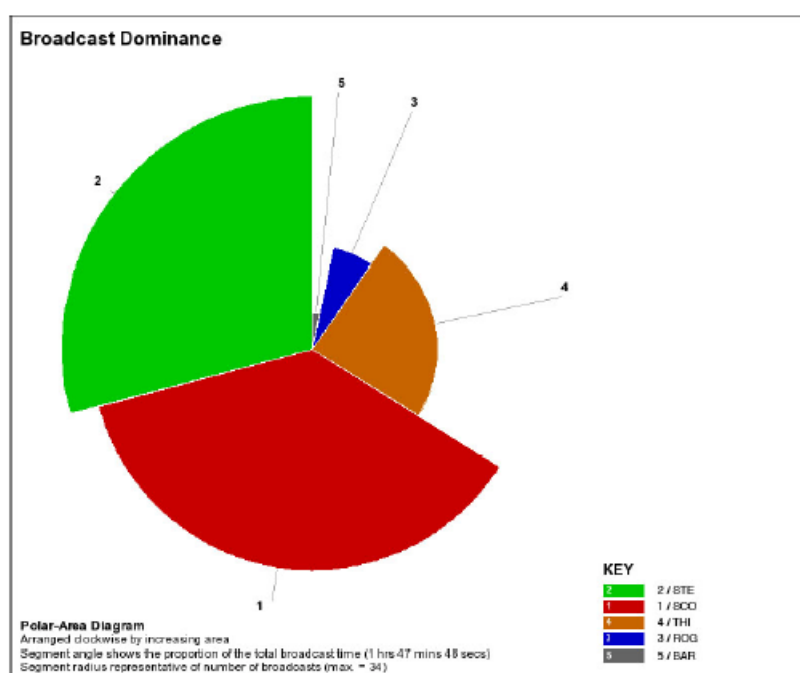


Figure 7: Broadcast Dominance in a Peer-to-Peer Student Meeting

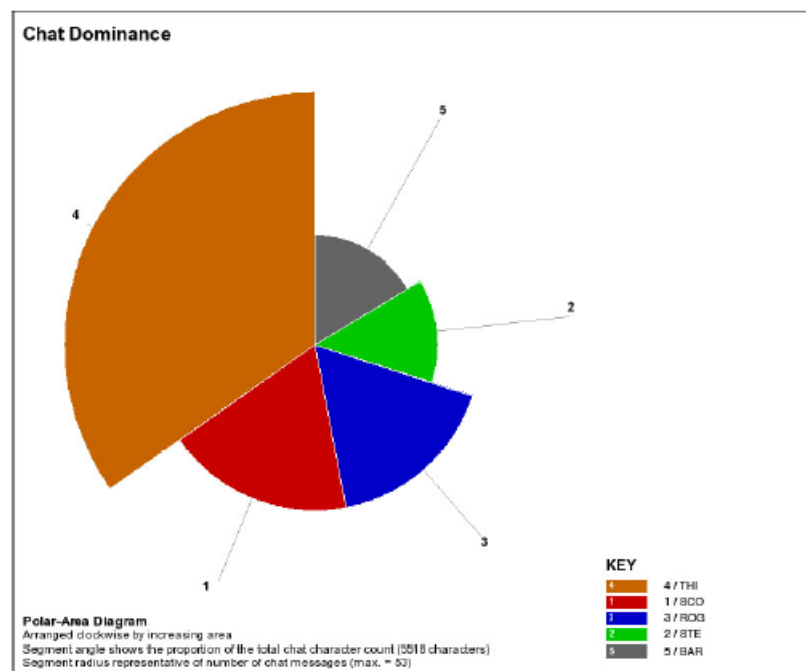


Figure 8: Chat Dominance in a Peer-to-Peer Student Meeting

It is worth noting for this event type, being significantly less formal than others discussed here that the chat log is also used extensively for emotional support, including phrases such as “cool”, “LOL” (laugh out loud), text smileys etc. It is also used for useful work-related information and comments to the person currently using the foreground channel.

## An Interview

<http://flashmeeting.com/fm/8e8032-3555>

A variety of public replays of interviews are hosted on the FlashMeeting server, focusing on e-Learning related issues. These events include two participants interchangeably taking turns. Usually, the interviewee occupies more than double of the time occupied by the interviewer, while the number of broadcasts is similar. This can be explained due to the turn taking of the question-answering pattern.

Figure 9 shows the interviewee occupying 69% of the total time with 5 broadcasts, totalling 718 seconds (12 minutes). The interviewer occupies a third of the total time with 7 broadcasts totalling 318 seconds (5.3 minutes), which is less than half the time occupied by the interviewee. However, the interviewer is the one dominating the chat, with all 7 of the text messages. The chat is possibly preferred in this case in order not to interrupt the flow of the person who answers the interview questions and to help steer the direction of the reply. The interviewer also has more time to type text than the interlocutor who is using the foreground channel. No other communication channels are used. Figure 9 shows the interviewee (2/DIE) using two thirds of available air-time, while figure 10 indicates that the interviewer (1/MAR) had 100% dominance in the chat.

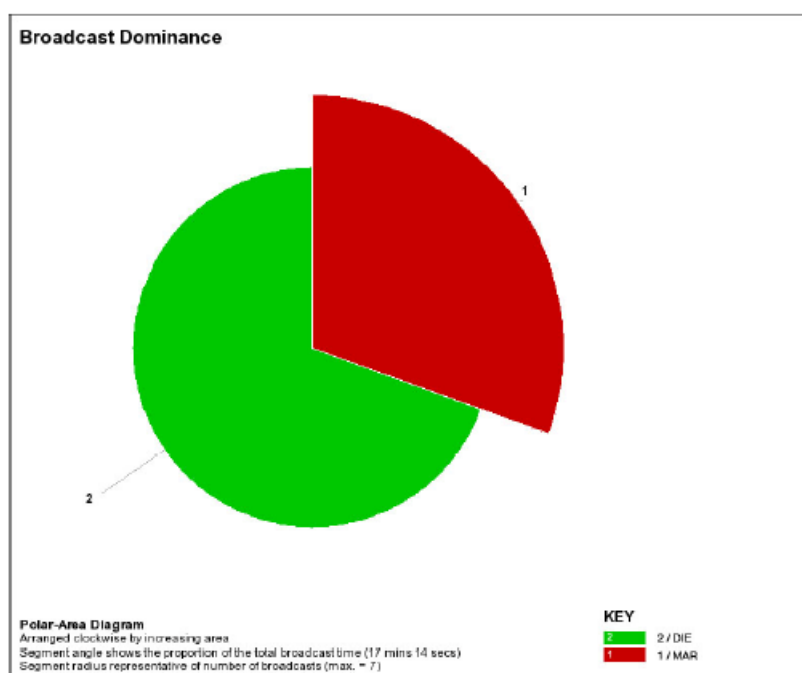


Figure 9: Broadcast Dominance in an Interview

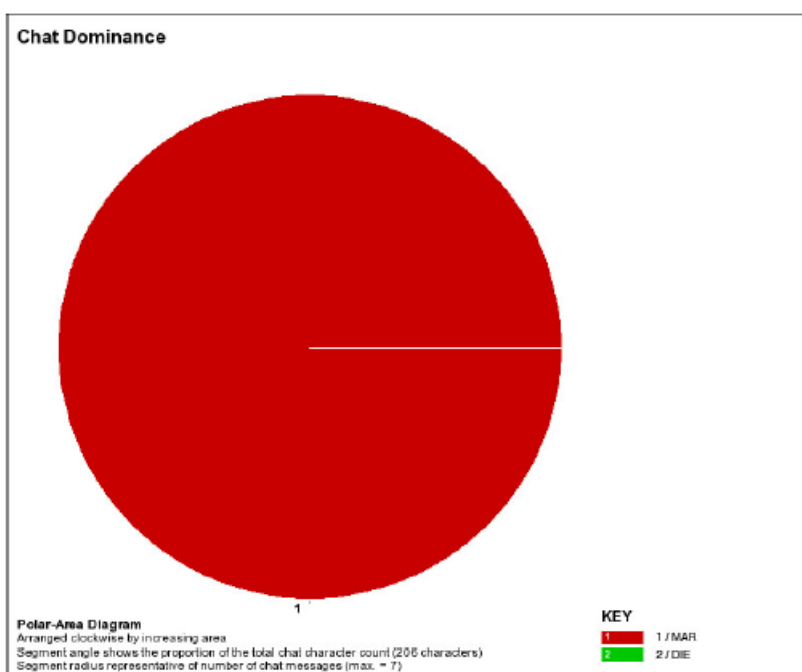


Figure 10: Chat Dominance in an Interview

## A Webcast Event

<http://flashmeeting.com/fm/590b7f-5943>

FlashMeeting has been also used on several occasions for webcasting because it is easy to record and reuse. This example public webcast is the 3<sup>rd</sup> of a set of presentations by different academics. As you would expect, the webcast shape shows a highly

dominant single main broadcaster taking most of the total time. In figure 11 this is nearly 100% of the time, in very few 'turns'.

As this type of event is typically a presentation to a locally present audience which is intended to be recorded only, in which case there is no real background chat used, or in this case (as figure 12 shows) is also for a remote audience who can join the locally present experience. As the main channel conveys the

speakers broadcast, the back channel is used by the remote audience to comment upon it and to chat amongst themselves about it. The most dominant text chat user, in this case 2/MAR supports and facilitates the discussion and maintains a 'technical support role' during the event with 64 of the 149 text

messages; whilst 7 of the 11 participants of the event were silent, without contributing any broadcasts or chat messages (see figure 12). Except for one emoticon, no side channels of communication were used in this event.

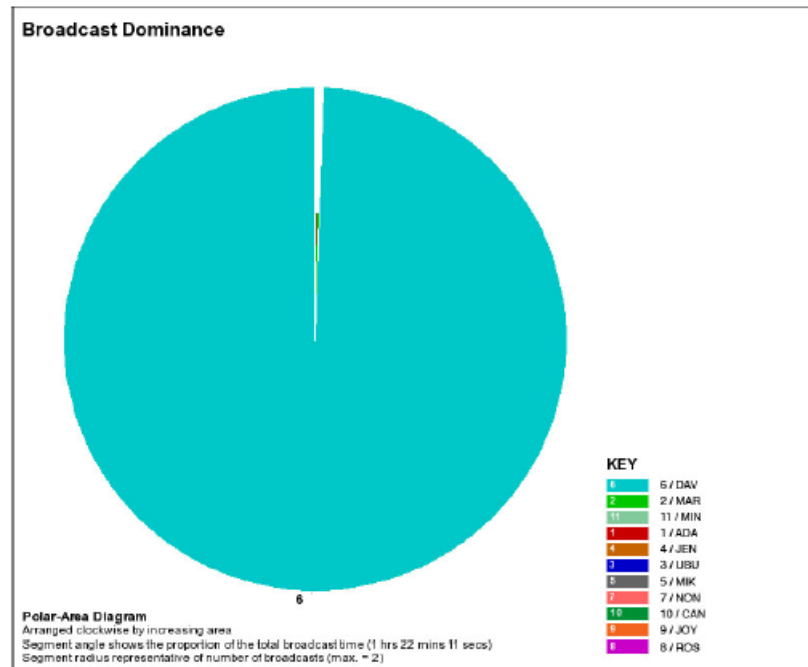


Figure 11: Broadcast Dominance in a Webcast

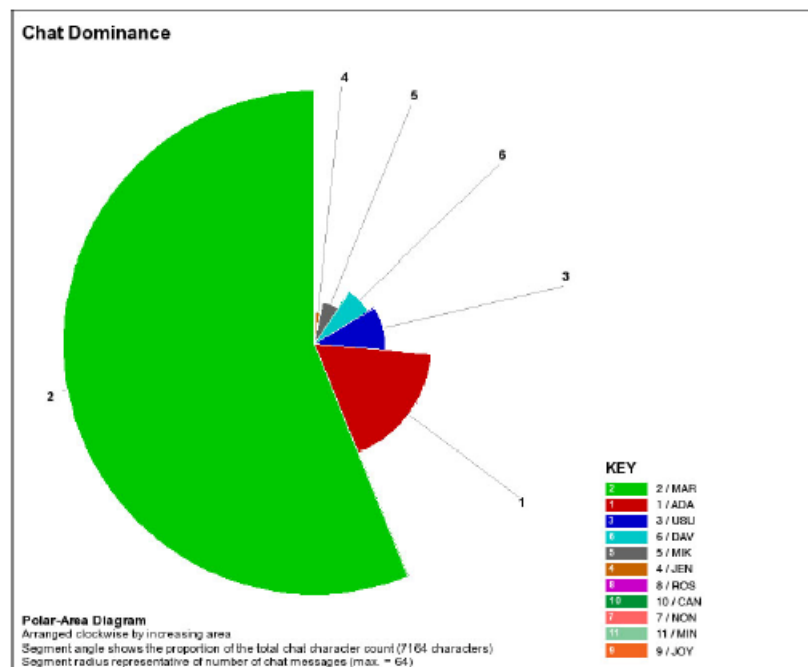


Figure 12: Chat Dominance in a Webcast

## A Remote Lecture

<http://flashmeeting.open.ac.uk/fm/73d3a6-5960>

Video lectures are very similar in visualisation patterns to webcasts. The difference in the polar area shapes are due to the more interactive nature of the experience. Typically, a webcast is more a broadcast event. In figure 12 the presenter did use the connection to engage with the remote audience, but only a little. Often the demands of a physically present audience mean that the software conferencing connection is used effectively as an 'encoder' for the broadcast. A webcast is usually a one-to-many event with little interactivity. In contrast, a remote lecture is typically focused entirely on the remote audience, and can therefore be more interactive, even in a one-to-many format. Event 5960 is not a typical one-to-

many lecture in that it was a room-to-room event in which a UK presenter joined a lecture room audience in Belgium. A number of the lecture room audience joined the connection to make use of the background and side channels whilst the foreground channel was projected at the front of the room.

As in the webcast, in this remote lecture, the main speaker again occupies nearly all of the air-time (Figure 13). The main broadcaster, 7/PET, is responsible for 5 of the 8 total broadcasts and 97% of the total time, totalling 57 minutes. The main speaker sent 6 out of the total of 31 messages (see figure 14), whilst the highest number of texts sent by an individual is 9. Interestingly, 106 emoticons were displayed in different phases of the meeting to show audience feedback to the lecturer.

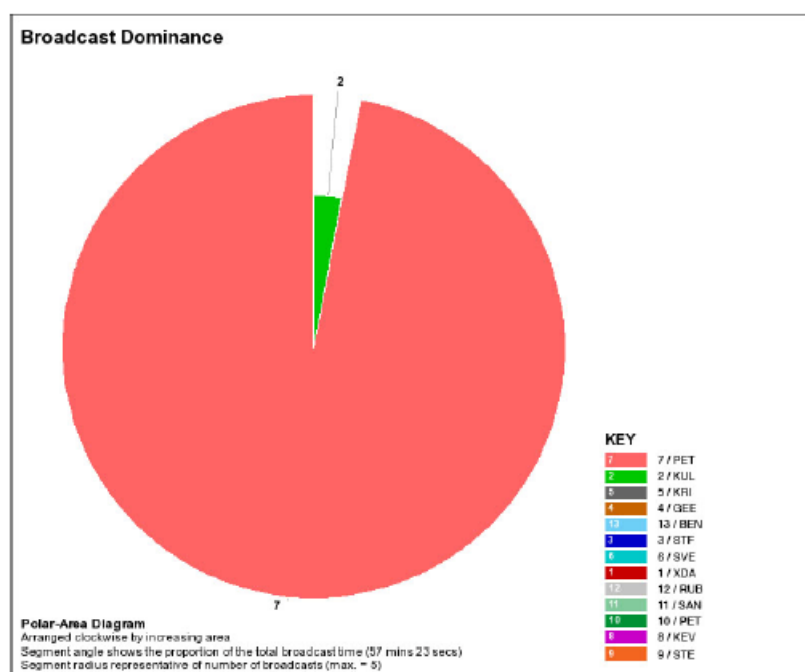


Figure 13: Broadcast Dominance in a Video Lecture

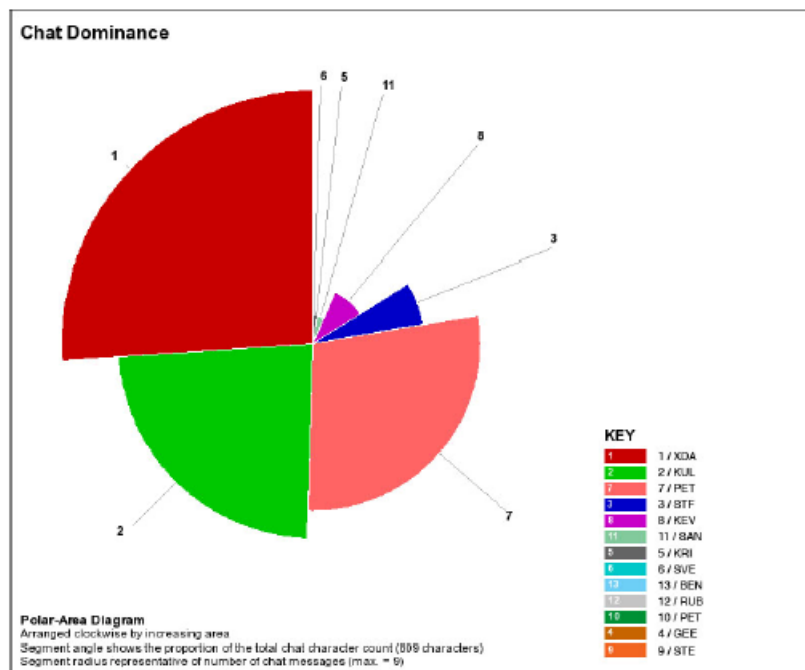


Figure 14: Chat Dominance in a Video Lecture

## Conclusions

In this paper we have contrasted six different events and proposed that we can begin to distinguish them as ‘different types of online meeting’ simply from their ‘shape’. We have described the shape of each event in terms of participants use of foreground, background and side communication channels, using features such as number of participants, broadcasts, duration, percentage of the total ‘air’ time occupied by the active users, as well as the amount of text messages and emoticons. We have also suggested a simple set of visualizations to help in this examination.

The six events discussed here range from 2 to 15 participants, who are dominant within the event in varying ways. We make no claims that these events are in any way typical of some sort of genre. In reality, we are pleased to claim only that they are both real and naturalistic, in that the participants had no other goals than their own need to communicate during these sessions. Any tasks attempted were their own, and for their own reasons – which were informally to do with their own work and learning. Indeed, they are selected for discussion here primarily because they are complex and yet public. However, we maintain that despite this it is possible to see distinct differences between the events from the shapes they make. Some of these differences are obvious, for example a 2 person event is highly likely to be different to a 15 person event, but some differences are much more subtle.

The interview discussed is the shortest type of meeting in duration, lasting around 17 minutes, possibly because the questions are prepared and thus define the structure and duration of the event. The webcast is quite long in duration, although it includes the smallest number of broadcasts, as it is not as interactive as other types of events. While a webcast can be long in duration, the peer-to-peer meeting lasted 2 hours, being highly interactive in terms of turn-taking, time distributed amongst multiple participants, and the highest amount of chat messages (254) that were used extensively for emotional support. This can be explained as participants can join in and drop out, in any meeting phase. Also, the attendees who did not use the audio channel contributed more chat messages. The seminar is another highly interactive event, with all communication channels used, and where the main speaker acts as a central focus of communication, leading different conversations with different individuals.

The results presented in the above section indicate that the patterns used in the various communication channels can define certain meeting types. Consequently, analysis of these patterns can be used to identify heuristics for automatic event type classification. For example, based on the audiovisual dominance of a main speaker, it can be predicted whether it is a presentation, either a webcast, a video lecture or a seminar. If the air-time dominance is divided equally to more than one speakers, then the meeting can be characterised as peer-to-peer. More evidence can be gathered by collecting a number of events for each type and comparing the communicative patterns,



as well as the role of participants. One challenge is that certain event types share similar characteristics; for example, a seminar and a project meeting, where both involve a moderator interacting with different participants and occupying more than a third of the total air-time.

In future work, we hope to extend these views to explore automatic meeting classification. Until now, systems have analyzed the transcription of the audio channel, to detect keywords indicating the theme of the videoconference (Watt et al, 2002, Kazman et al, 1996). These techniques may also be applied on the text chat, to detect which words demonstrate emotional support in different kinds of meetings. Visualization tools can be used to transcribe argumentation and group memory from a meeting considered as an event, as well as to capture the meeting structure, which can include sub-events, such as 'Giving-a-Talk', 'Sending-an-Email' etc., and can be mapped onto a more conventional time-line (Bachler et al, 2003). We propose a classification of the structure of possible meeting types, based on the polar area diagrams generated by the FlashMeeting system.

In addition to meeting identification, these shapes may help us to explore if user roles themselves can be automatically detected in an event. The polar diagrams presented in this paper may help event users understand their individual roles within events, possibly interactively and even in real time. From this perspective, it may be possible for users to 'improve' their performance in a series of meetings, through time and even change their roles.

Overall, we do not argue that the shapes we have discussed necessarily represent 'typical' meeting types of 'typical' communities of practice, however we do argue that they represent a new way to look at such events with significant promise for the better understanding of live online meetings for observers and participants alike.

## Acknowledgement

The authors would like to acknowledge the support of the EU Network of Excellence in Professional Learning, Prolearn; and the Hewlett Foundation for the support of the OpenLearn Initiative. In addition to the listed authors we would like to acknowledge the contribution of Jon Linney of the Open University's Knowledge Media Institute.

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